Challenge Problems

from Ross Eckler, Word Ways editor
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One of the most attractive attributes of logology is the fact that often an individual can contribute to this field without a lengthy apprenticeship. This is particularly true for the computer-literate logologist, for the computer has made many previously-daunting tasks very simple, and opened avenues of investigation once deemed hopeless. Here are a handful of challenges which ensure logological fame, if not immortality, to their solvers.

Large word squares

The search for a 10-by-10 word square (a 10x10 square of letters whose ten horizontal rows spell words and whose columns spell those same words), using words or names from English-language sources, has attracted the attention of many logologists. In addition to solidly-formed words like ERADICATOR, one can also allow hyphenated words, place names, or even combined first and last names of real people. It has been estimated that, with a list of some 250,000 ten-letter words, the chances are about 50-50 that such a square is possible. Computers working with lists of 50,000 or 60,000 words typically fill in five to seven lines of the square, leaving the others for hand search.

The first 10x10 word square, which appeared in 1921, was constructed entirely of tautonyms (words like TANGATANGA, which have two repeated five-letter parts) and so is not very satisfying. The challenge is to make as good a ten-square as possible - ideally, one containing all dictionary-sanctioned words. A number of such nine-squares have been found, and even a few in which all the words come from a single dictionary. For instance, the nine words in this 9x9 square

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N E C E S S I S M
E X I S T E N C E
C I R C U M F E R
E S C A R P I N G
S T U R N I D A E
S E M P I T E R N
I N F I D E L I C
S C E N A R I Z E
M E R G E N C E S
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(constructed by Eric Albert and his computer) are all in Webster's Second Unabridged. Two of the best 10x10 squares yet constructed are shown below

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D I S T A L I S E D
I M P O L A R I T Y
S P I N A C I N E S
T O N Y N A D E R S
A L A N B R O W N E
L A C A R O L I N A
I R I D O L I N E S
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D E S C E N D A N T
E C H E N E I D A E
S H O R T C O A T S
C E R B E R U L U S
E N T E R O M E R E
N E C R O L A T E R
D I O U M A B A N A
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S I N E W I N E S S          A D A L E T A B A T
E T E R N N E S S E          N A T U R E N A M E
D Y S S E A S S E S          T E S S E R A T E D
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by Jeff Grant (1990/2002) Copyright 2002 Rex Gooch

Jeff Grant's 10-square contains four dictionary words, two pluralized chemical terms, one term from the field of psychology, one place name, and two names of real persons (one pluralized, as would be used in referring to more than one person with that same name). Rex Gooch's square includes seven dictionary terms (two hyphenated), one word from the scientific term for a specific animal, and two place names.

Although quality in a word square is subjective, the basic challenge is to find even "better" ten squares than these - for example, one containing only words dictionary words. Certainly a large pool of 10-letter words will be required, along with some hard work and maybe luck, to improve on these.

And with such high-quality ten-squares now in existence, the next obvious challenge lurks: an eleven square!

The Pangrammatic Window

The Beth Book, a popular 1897 novel by Sarah Grand (republished as recently as 1980 by The Dial Press), contains the sentence (page 200 of the Dial Press edition):

> It was an exquisite deep blue just then, with filmy white clouds drawn up over it like gauze to veil its brightness.

The 65 contiguous letters shown in red are a *pangram*, containing each letter of the alphabet at least once. Can one find a pangrammatic window in English writing having fewer letters? Discussions of pangrams are not allowed -- the window must be accidental rather than deliberate.

The remarkable *Beth Book* pangram was reported by A. Cyril Pearson in *The Twentieth Century Standard Puzzle Book* in 1907. Its status as the shortest known accidental pangrammatic window stood for 95 years until 2002, when Mike Keith found two 64-letter examples. From the novel *A French Encounter* by Cathy Williams (Mills & Boon, 1992):

> Alyssa's heart was beating ferociously, and there was a throbbing in her temples that was making her feel quite dizzy. Or maybe it was just his proximity having that effect on her.

And from an article entitled *The Prat who Calls Himself the Hitman* from the U.K. magazine *Sky* (August 1989):

> "I'd like to be able to spend some time in Japan, which I find very beautiful and relaxing."
> Back at the Ritzy queues are forming around the block...

In 2004 Dan Tilque found a new record - 63 characters long - in the Dec 5, 1903 issue of

The Detroit News:

> The New York Yankees made their first big move in the off-season, strengthening their rotation by agreeing Thursday to acquire Javier Vasquez from the Montreal Expos. For Vasquez, a 27-year-old right-hander, New York sent first baseman Nick Johnson, outfielder Juan Rivera and left-hander Randy Choate to Montreal."

(The pangrammatic window only has 61 letters but perhaps the two digits should also be counted, which is why we said "63 characters long".)

Surely there are even shorter examples waiting to be found, but discovering them is not a trivial task. Can you find one?

Self-descriptive Numbers

If A=1, B=2, ... , Z=26, the natural numbers ONE, TWO, ... have scores 34, 58, etc. Note that there are two different versions of this exercise: the "AND version", in which numbers containing hundreds are written as, for example, TWO HUNDRED AND TWELVE, and the "no-AND version", in which ANDs are not used.

In the AND version, there are exactly two self-descriptive numbers, in which the value of the number in words is the same as the number itself: TWO HUNDRED AND FIFTY ONE, and TWO HUNDRED AND FIFTY NINE.

There are *no* self-descriptive numbers in the no-AND version, although TWO HUNDRED NINETEEN and TWO HUNDRED FIFTY-THREE miss by only one. However, one can rearrange the alphabet to create self-descriptive numbers (I=1, S=2, X=3..., for example, creates SIX=6). For what alphabetic rearrangement is the number of self-referential numbers maximized? The best-known such rearrangement (again, this is for the no-AND variant) yields 38 of them. Can you do better? How many numbers can be made self-descriptive if each letter can be assigned any real number (like -3 1/2 or 6 3/4), with the proviso that no two letters are allowed to have same numerical value?

Word worms and knots

A word can be diagrammed in three-dimensional space by identifying its letters with vectors, each pointing in a different direction; each word thus becomes a segmented worm twisting through space. If one considers the three-dimensional lattice of points with integer coordinates, then, by a stroke of luck, there are 26 directions by which one can step from one point to another adjacent one (whose coordinates differ by at most one from the previous point). We can identify these 26 directions with the letters of the alphabet as in the diagram below:

A B C J K L R S T

D E F M * N U V W

G H I O P Q X Y Z

A small number of word worms such as ANY, ROIL and DISINGENUOUSNESS form closed loops, returning to their starting points. Some closed loops (such as the non-word TYDBNYRDI or the two-word "phrase" YO ELUVIAL) actually manage to tie a knot in space. It has been proven that nine letters is the minimum needed to form a knot, but so far no one has found a single word that by itself ties a knot. Does one exist? Large word lists have been searched by computer without finding one, so it won't be easy! Perhaps in another language?

Permutation names

ROGER O. GREGOR is a (hypothetical) twelve-letter name containing the letters E, G, O and R in all 24 possible orders:

EGOR = rogEr o GregOR,
EGRO = rogEr o GRegOr,
EOGR = rogEr O GRegor,
etc.

Can you find a real person whose name is only twelve letters in length having this property (of containing all 24 permutations of four letters)? Dmitri Borgmann found the fourteen-letter GEORGE O. GREGORY in the 1981 Richmond Virginia telephone directory.